$Cl_2/BCl_3/Ar$ 유도 결합 플라즈마에서 온도에 따른 ZrO_2 박막의 식각

양 설, 김동표, 이철인*, 엄두승, 김창일
중앙대학교, 안산공과대학*

Temperature Dependence on Dry Etching of ZrO_2 Thin Films in $Cl_2/BCl_3/Ar$ Inductively Coupled Plasma

Yang-Xue, Dong-Pyo Kim, Cheol-In. Lee*, Doo-Seung Um, and Chang-Il Kim
Chung-Ang Univ., Ansan college of Technology*.

Abstract: High-*k* materials have been paid much more attention for their characteristics with high permittivity to reduce the leakage current through the scaled gate oxide. Among the high-*k* materials, ZrO_2 is one of the most attractive ones combing such favorable properties as a high dielectric constant (k= 20 ~ 25), wide band gap (5 ~ 7 eV) as well as a close thermal expansion coefficient with Si that results in good thermal stability of the ZrO_2 /Si structure. During the etching process, plasma etching has been widely used to define fine-line patterns, selectively remove materials over topography, planarize surfaces, and trip photoresist. About the high-*k* materials etching, the relation between the etch characteristics of high-*k* dielectric materials and plasma properties is required to be studied more to match standard processing procedure with low damaged removal process. Among several etching techniques, we chose the inductively coupled plasma (ICP) for high-density plasma, easy control of ion energy and flux, low ownership and simple structure. And the BCl_3 was included in the gas due to the effective extraction of oxygen in the form of BCl_xO_y compounds.

During the etching process, the wafer surface temperature is an important parameter, until now, there is less study on temperature parameter. In this study, the etch mechanism of ZrO_2 thin film was investigated in function of Cl_2 addition to BCl_3/Ar gas mixture ratio, RF power and DC-bias power based on substrate temperature increased from 10 °C to 80 °C. The variations of relative volume densities for the particles were measured with optical emission spectroscopy (OES). The surface imagination was measured by scanning emission spectroscope (SEM). The chemical state of film was investigated using energy dispersive X-ray (EDX).

Keywords: ZrO_2, Dry Etching, $Cl_2/BCl_3/Ar$, ICP, Temperature